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WATER POLLUTION IN THE UNITED STATES A REPORT ON THE POLLUTED CONDITION OF OUR WATERS AND WHAT IS NEEDED TO RESTORE THEIR QUALITY

Public Health Service
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May 1951

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Water Pollution

IN THE UNITED STATES

A report on the polluted condition of our waters and what is needed to restore their quality

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Public Health Service

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The waterways of the United States have always been one of our greatest natural resources. They have helped to shape the Nation's growth and to spread our people across the land. They have provided us, from colonial days, with food and transportation and power. As our country grew, they have become increasingly vital to American industry. This country without its water resources would be close to helpless.

Today our lakes, streams, bays, and rivers are being spoiled more and more by man-made pollution. Long ago, because of municipal sewage, most cities and towns had to install purification plants that would make water safe for human use. But the industrial wastes of our own time have more than doubled the degree of pollution in our surface waters.

Our cities and our industries have far outstripped facilities to control water pollution. This would be serious at any time. In the present emergency, the threat to human life and to industrial production can dangerously impair the health and strength of the Nation.

This threat must be met. It can only be met by immediate cooperative action on the part of industry and Government—Federal, State, and local. This Nation-wide survey is intended to show the nature of the water-pollution problem, in the hope of spurring just such cooperative action.

Oscar R. Ewing

Federal Security Administrator.

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Public Health Service
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In war or peace, our country's waters are vital to its very existence. Their polluted condition has aroused national concern. The productive capacity of our highly industrialized and urbanized economy is seriously threatened.

The President's Water Resources Policy Commission has said: "Grave as it is now, the pollution problem is bound to deepen as population and industry grow. This need not be. The losses and injuries we now sustain are by no means irretrievable if we act now."

Aware of this menace, doubly ominous because of defense demands, public demand for cleansing our waters is widespread.

In response to this feeling the 80th Congress passed the Taft-Barkley bill, Public Law 845, instructing the Public Health Service to "collect and disseminate information relating to water pollution and the prevention and abatement thereof."

This publication presents the basic facts of our water pollution problem—how and where the pollution originates; its sources, their number and location; what is needed to get it under control.

The information has been assembled with the cooperation of State and interstate water pollution control authorities working with other State officials, county and city officers and representatives of industry. Federal agencies have also been of great assistance.

The Public Health Service gratefully acknowledges this cooperation.

Leonard A. Scheele

SURGEON GENERAL

May 1951

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The River

The river — mainstay of modern civilization, and pleasant companion to man, if undefiled . . . but an obstruction to economic and social progress, and a menace to life and health, if polluted.

PART 1

GENERAL BACKGROUND OF THE WATER POLLUTION PROBLEM

When this country was young, rain and snow falling from clouds in the water cycle and flowing seaward were relatively uncontaminated. But the country's settlement was rapid. Population mounted. Industry grew. The United States is now highly urbanized and industrialized. And tremendous amounts of municipal and industrial waste pour into our rivers, lakes, and bays.

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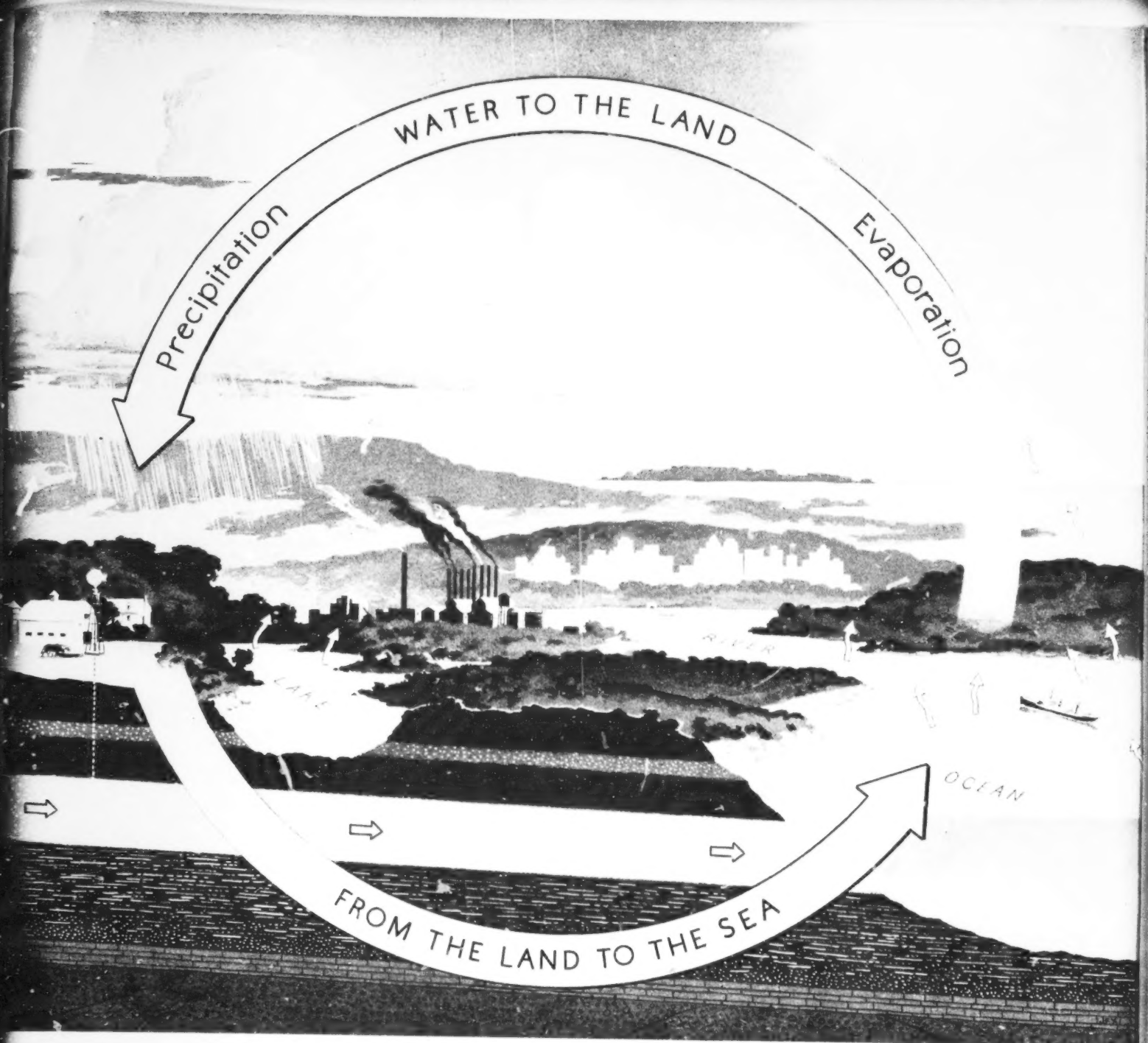


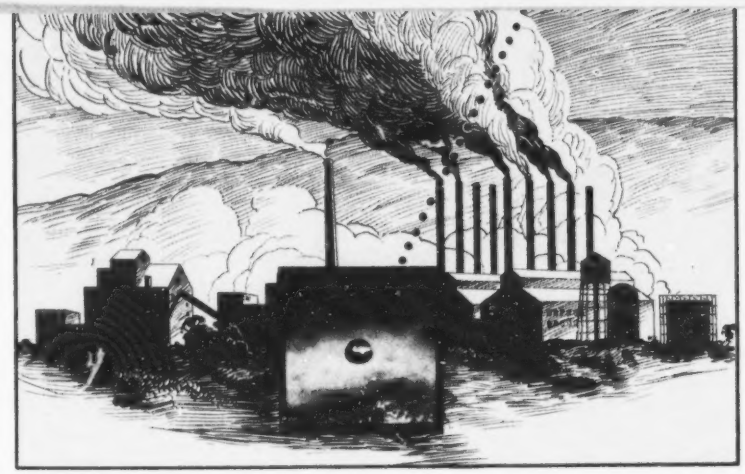
The Water Cycle and Pollution

Nearly everyone knows about the water cycle—how moisture falls from the clouds, pursues many useful paths on earth, is purified by plant transpiration and natural evaporation to rise again and be precipitated once more. It is a continuous process arousing attention only when too much water or too little—flood or drought—occurs.

Familiarity with this everyday miracle and its minor deviations from the norm through the centuries has imbedded the misleading belief that water, like matter in general, is indestructible regardless of what is done to it; and that practically speaking, it has only one characteristic to be considered: Quantity (how much or how little) at a specific place.

In a sense nothing could be further from the truth. When you destroy the usefulness of anything, you have, for all practical purposes, destroyed the thing itself. In this sense, water *can* be destroyed; and it can be destroyed because of its other important characteristics: *Quality*.

When pollution impairs the quality of water to the point of unfitness for human use we have, in effect, de-



The quality of water begins to deteriorate even before it reaches earth—falling raindrops pick up atmospheric dust on their way.

stroyed that water. We shall never again recapture that particular amount of water for our use. It has been lost, for one round of the water cycle, forever.

But why be concerned about losing some water? Isn't it nearly everywhere, like the air, and free?

That, too, is a general misconception. We are short of water in many, many places, especially in heavily populated areas where demand is greatest.

The demand for water (and its total cost) increases as population and industry expands—only more so. Our population has doubled since 1900, but total water use has increased six times.

Furthermore, water is not free. Treatment of water to make it suitable for use costs money. The present national water bill runs to hundreds of millions yearly, not including the cost of the capital investment in buildings and equipment.

The more polluted our waters become, the more costly their treatment for the various uses they must meet.

Polluting our rivers, lakes and bays and then trying to "purify" that water to usable condition is like locking the barn door after the horse is stolen.

What is wanted is prevention rather than cure. We must attack the pollution problem at the point where the wastes are discharged rather than where the water is used.

No water except that in the laboratory, of course, is 100 percent pure. As water is formed in the sky it gathers impurities from its very inception, from the atmosphere. It is born impure, so to speak, and picks up still more atmospheric dust or smut as it falls to earth. However, even after it has fallen, and is flowing seaward, the quality of water is high enough for nearly any human use: "Pure enough to drink," as the saying goes. But when water comes into contact with human activities, quality or "purity" degenerates fast.

Bad farming, overgrazing or deforesting multiply immensely the soil particles normally carried by flowing water as a result of natural erosion. Then towns and cities dump in the sewage and refuse of millions of people, and thousands of industrial plants add their load of poisonous waste. The water that Nature gave us is no longer water but an unnatural concoction of man and an offense to society.

Raindrops striking the earth are like miniature bombs that blast soil particles loose and incorporate them with the water—and the quality of water is impaired.

Municipal and Industrial Pollution

Cities are our greatest users of water, yet few of their residents know the source of their supply or what happens to it after use. Not until it comes out of the tap looking cloudy, or is suspected of causing illness, do we give it further thought.

Nearly two-thirds of our drinking water comes from surface sources—rivers, dammed streams (reservoirs), or lakes. And most city dwellers whose water comes from the river would be shocked to learn that a considerable portion of it has already been flushed through someone else's bathroom.

Such ignorance is blissful, however, for today's water purification plants provide a liquid that is cleaner and safer than most "raw" untreated water. Wherever there is pollution, raw untreated waters carry the seeds of disease and death. Years ago, typhoid fever taught us that.

Our municipal sewers discharge toilet flushings, bath and wash water, kitchen sink garbage, restaurant and laundry washings, mortuary and hospital refuse—in fact everything imaginable that can be got rid of by pouring down the drainpipe.

If a city lacks sewage treatment facilities it usually discharges this waste directly into a watercourse. If the watercourse is large enough, the bacteria in the water (and in the raw sewage itself) in time will "eat up" the organic portion of the material and cause its eventual decomposition and disappearance.

This biologic decomposition consumes oxygen, however, and when the oxygen in water is used up by such a process, all other life that depends on it dies. Fish, shrimp, crayfish, mussels, clams, oysters, snails, beneficial insects and their larvae, and even certain kinds of plants, are suffocated. Animal and bird life disappears. And a foul stench of death advertises that the watercourse has become an aquatic graveyard.

A sewage treatment plant, designed to allow maximum practical use of water resources, removes much of the solid matter in domestic waste (which can be made available to farmers and gardeners as organic fertilizer). Treatment speeds up natural action so that the fluid discharged from the sewer outfall requires a great deal less natural decay. The watercourse is not burdened beyond its limit and remains suitable for the uses required of it.

Industrial Waste

Industrial waste in this country is a more vexing problem than our municipal sewage. The wastes from our industries are as varied and complex as American industry itself.

American industry is known the world over for its volume of output and its technological aggressiveness. Wastes of all kinds accompany this production; and intensive laboratory research and experimentation plus actual tests and pilot plants in the field are required to ascertain the most economical methods of treating them to reduce their harmful effects or convert them to useful byproducts.

Industrial waste consists generally of oils, acids, chemicals, greases, mineral salts, lignin, and animal and vegetable material—some virulent, others noxious, and still others merely nauseous and offensive to the eye and nose.

Some of these wastes are highly poisonous and corrosive. Others are even more damaging to water quality than sewage. Sanitary engineers customarily use "oxygen demand" (or amount of air required for decomposition of waste) to estimate the pollution in a body of water. This is a convenient means of comparing the pollutional effect of industrial waste with sewage. It reveals that the oxygen demand for decomposing meat packing house waste, for example, may run ten times higher than that of ordinary sewage.

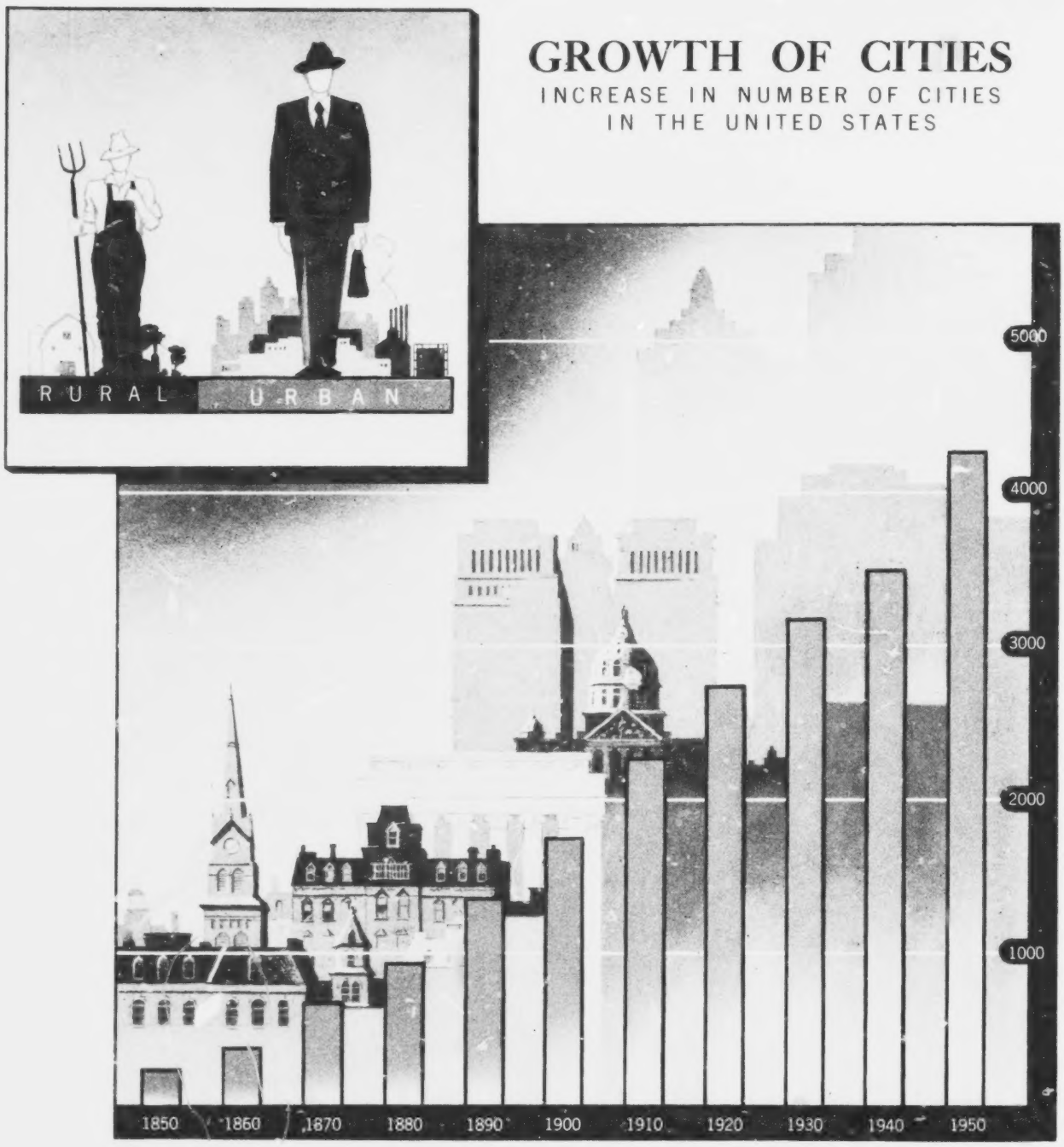
The total pollution load now being carried by the waters of this country, including domestic and industrial waste, is conservatively estimated to exceed the raw untreated sewage from a population of 150 million. By sheer coincidence, this happens to be our present population.

The question then arises: Don't we have any plants treating sewage or industrial waste at all, in the United States? We do, of course—over 9,000 of them. If we did not, the pollution pouring into our streams, lakes, and bays would be probably twice what it is now.

Waste from industry accounts for this seeming anachronism: a waste problem equal to the population of the country in spite of thousands of treatment plants—because more than half this 150 million population load is due to the oxygen demand of industrial waste.

Untreated sewage poured into our waters consists of human and other excrement and urine, garbage and other unwanted waste (including that from industrial plants with city sewer connections), later joined by trash and refuse of every imaginable kind.

Although many kinds of industrial waste are relatively unnoticeable after their discharge into water, and some can be detected only by chemical analysis, nearly all, if in sufficient quantity, make water unfit for immediate use. This air photograph reveals how the discharge from a mill clouds up nearby water.



(Source: Bureau of the Census, Department of Commerce)

Pollution is generally proportional to the number of people and industries in an area. Our country 100 years ago was largely rural with only a few cities and factories. But today three out of five Americans live in cities, and the majority of our population derives its livelihood from industry. The rapid urbanization and industrialization of this country in the short space of a century has raised many problems, but few are graver or more critical than pollution.

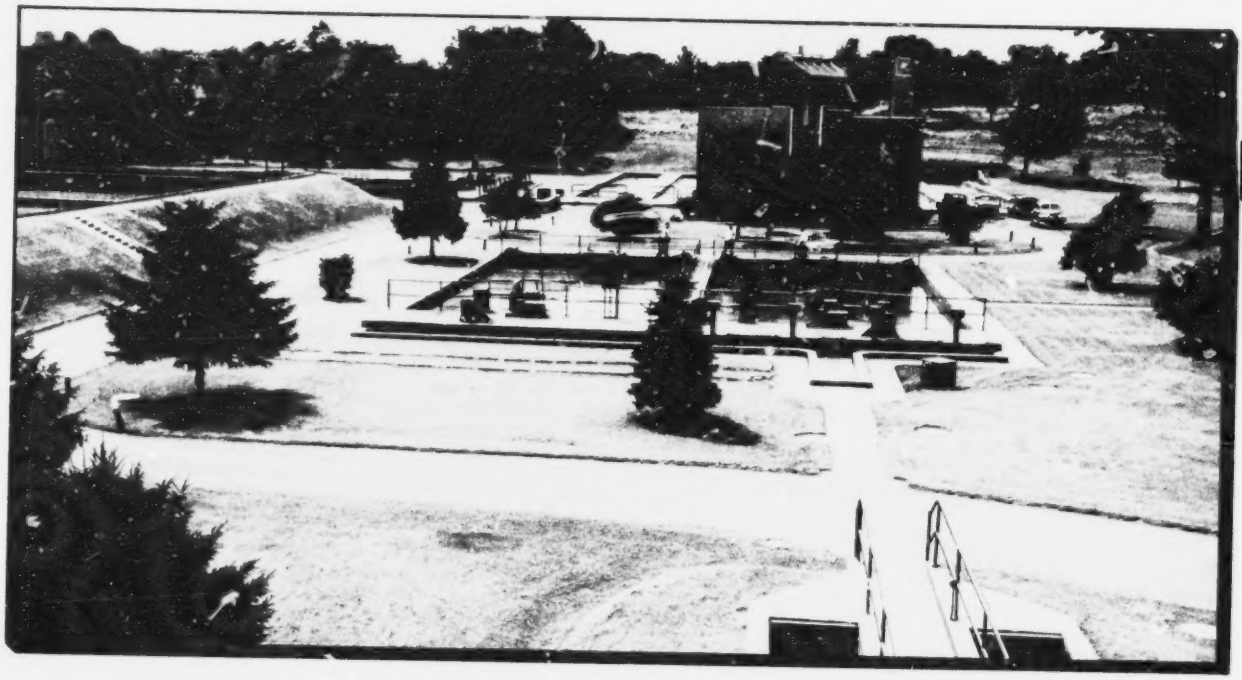
GROWTH OF INDUSTRY

INDEX OF RISING INDUSTRIAL PRODUCTION IN THE UNITED STATES (1935-39 average equals 100)

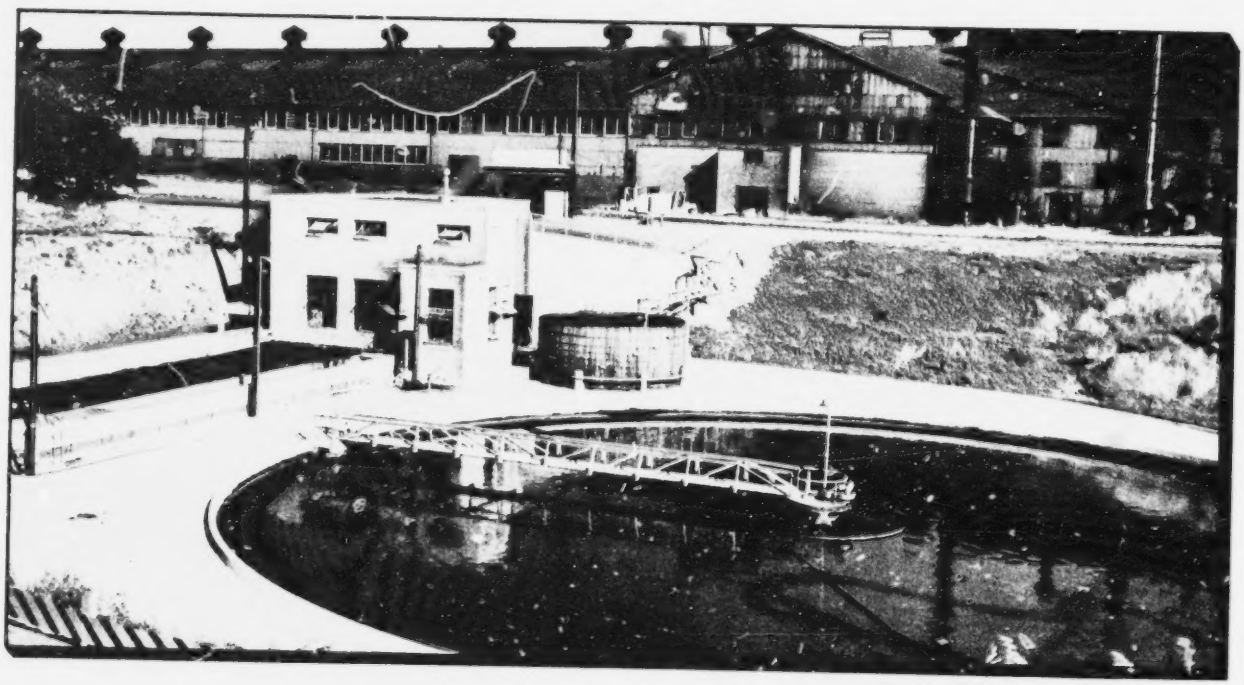
Source: 1919-49 Federal Reserve Board index of industrial production. 1950 estimated. 1892-1918 indexes compiled by National Bureau of Economic Research linked to Federal Reserve Board index on basis of year 1919.

The strength of the United States lies in its people, its natural resources, and its tremendous industrial power. Our industrial production has more than doubled in the last 15 years. But "a shortage of water for industrial purposes," states the National Association of Manufacturers, "just as surely as a shortage of manpower, of raw materials, or of capital could defeat our hopes for future growth and prosperity, and even imperil our national safety."

This shortage already exists. And pollution is one of the contributing factors to the shortage.



Municipal sewage treatment plants remove 40 to 95 percent of the damaging matter before discharge into a body of water.



Industrial waste treatment plants like this one can satisfactorily reduce the quantity of factory waste.

PART 2

GRAPHIC ANALYSIS OF THE POLLUTION PROBLEM

There are over 22,000 sources of pollution in the United States: 11,800 municipal sewer systems and 10,400 factory waste outlets. Despite the reduction of waste by 9,300 treatment plants (6,700 municipal and 2,600 industrial) the waste still discharged into our waters equals that from over 150,000,000 people. We need 6,600 more municipal sewage plants or additions, and 3,500 more industrial waste treatment plants or additions. There are 7,000 other needs (1,600 municipal and 5,500 industrial) as yet unascertained.

The situation is summed up and shown graphically on the following charts: 1—municipal pollution, 2—industrial pollution, 3—treatment plant capacities, 4—their efficiency of operation, 5—the number built recently, 6—the number under construction or planned, and 7—the new plants, replacements, additions, or enlargements required.

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POLLUTION:

NATIONAL TOTALS

Municipalities* with sewers 11,811

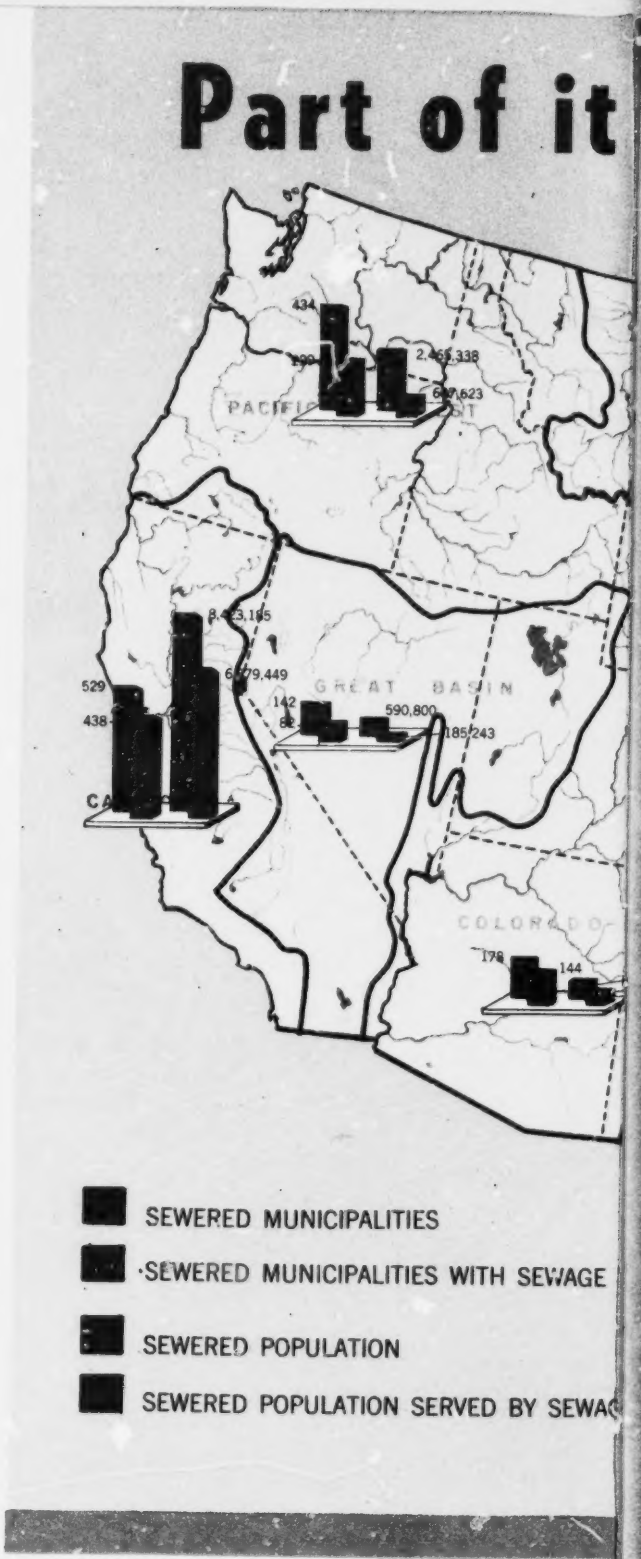
Serving a population of . . . 91,762,000

Municipalities* with sewage treatment plants 6,628

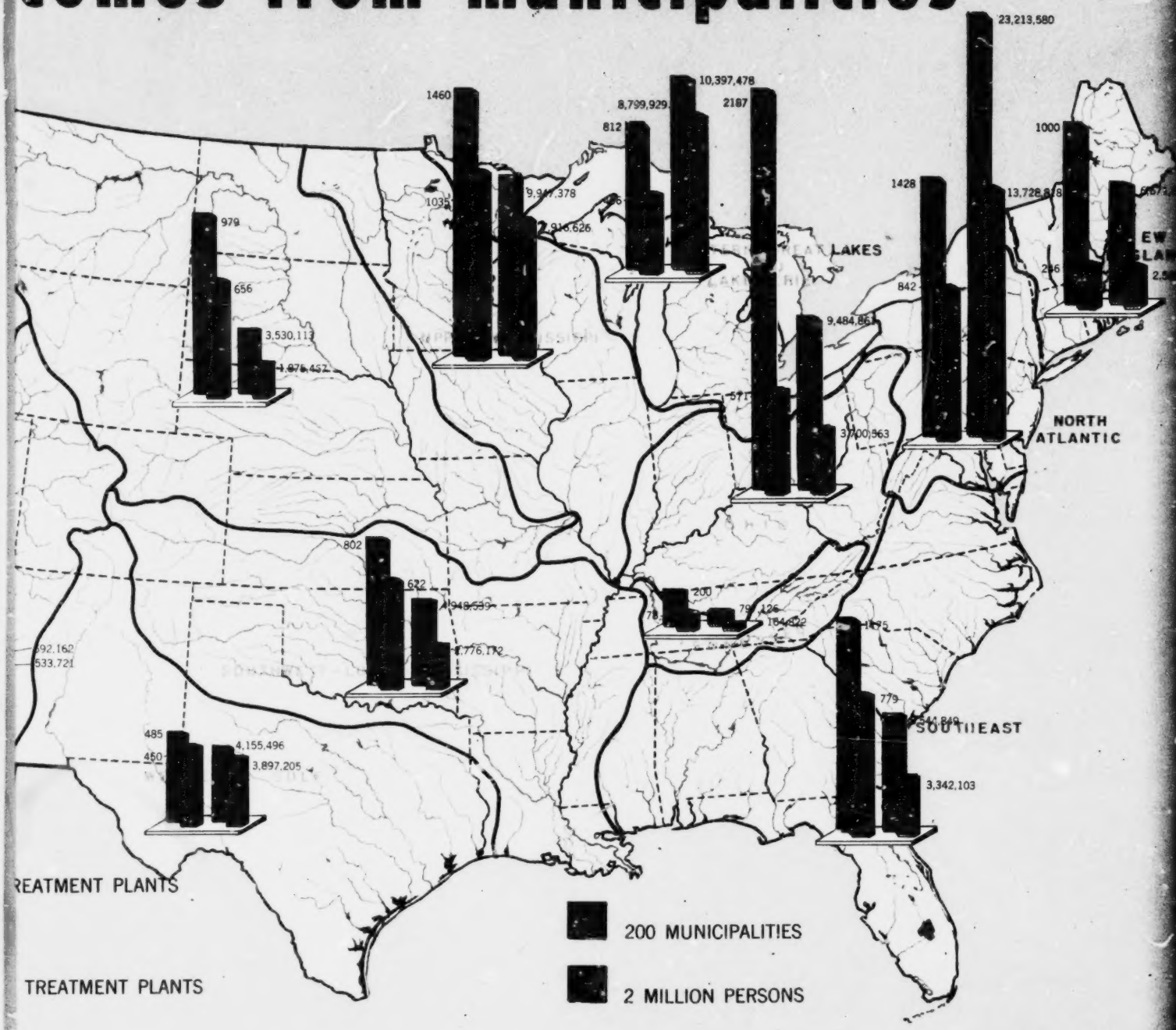
Serving a population of . . . 56,494,000

The total waste discharged into our waters by the above 11,811 sewered municipalities is not known. This information is lacking for 4,890 of them, providing sewer service to 40,000,000 people. This information must be obtained before the full measure of municipal pollution is known—which is, of course, no obstacle to current anti-pollution programs. The other 6,921 municipalities, serving 50,000,000 people, together with many factories which add substantial quantities of waste to the municipal sewer load, discharge pollution equal to that from a population of nearly 48,000,000.

*Cities, towns, villages, sewer districts, and institutions.



comes from municipalities



Pollution follows people. The great percentage of this country's population is located within several hundred miles of the Great Lakes and Atlantic Seaboard. Although there are fewer cities west of the Mississippi, water shortages due to arid climate in the West make the pollution problem as serious as in the East.

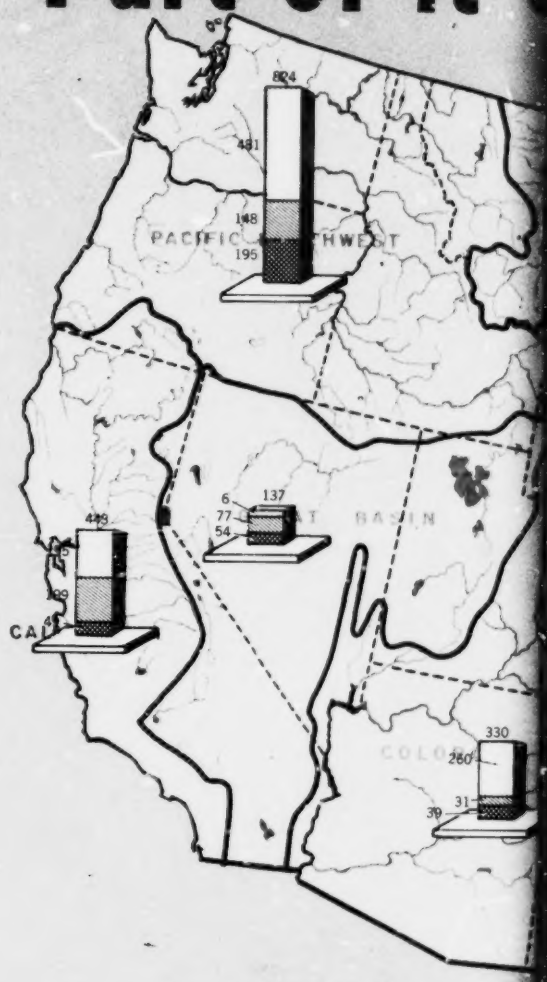
POLLUTION:
NATIONAL TOTALS

Industries

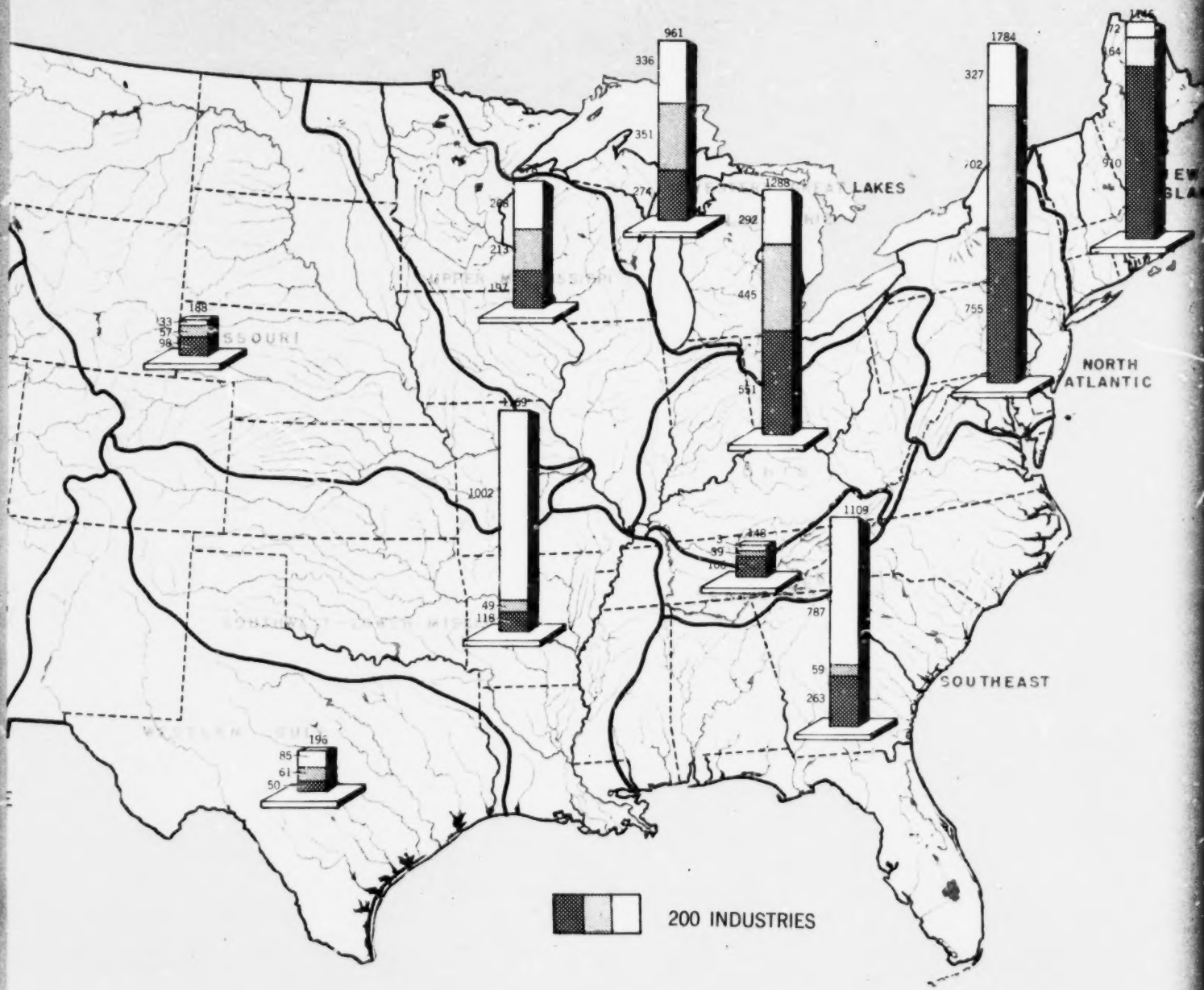
discharging waste . . .	**10,401**
not treating their waste	**3,659**
treating their waste	**2,595**
treatment facilities undetermined . . .	**4,147**

Of the 10,401 industries, about 6,000 discharge organic or decomposable waste which is measurable on the same basis as domestic sewage. Information submitted for about 2,000 of these organic waste-producing industries shows a pollutional effect equal to that from nearly 50,000,000 persons; comparable information on about 4,000 other organic waste dischargers is lacking. There are also over 2,500 inorganic (acids, poisonous chemicals, etc.) waste dischargers whose pollution is not measurable on a population basis, and over 2,000 industries whose type of waste (organic or inorganic) has not yet been reported. This information must be obtained before the full impact of industrial pollution on U. S. waters can be assessed. Again, this is no obstacle to current antipollution programs.

Part of it



omes from industry



Industry generally requires large numbers of workers. Its natural location, therefore, is near population centers. As a consequence, industrial waste is added to municipal sewage, magnifying the disposal problem. In the West and Southwest, where industry is less developed, the problem is nevertheless acute because of short water supply.

TREATMENT PLANTS: Are they

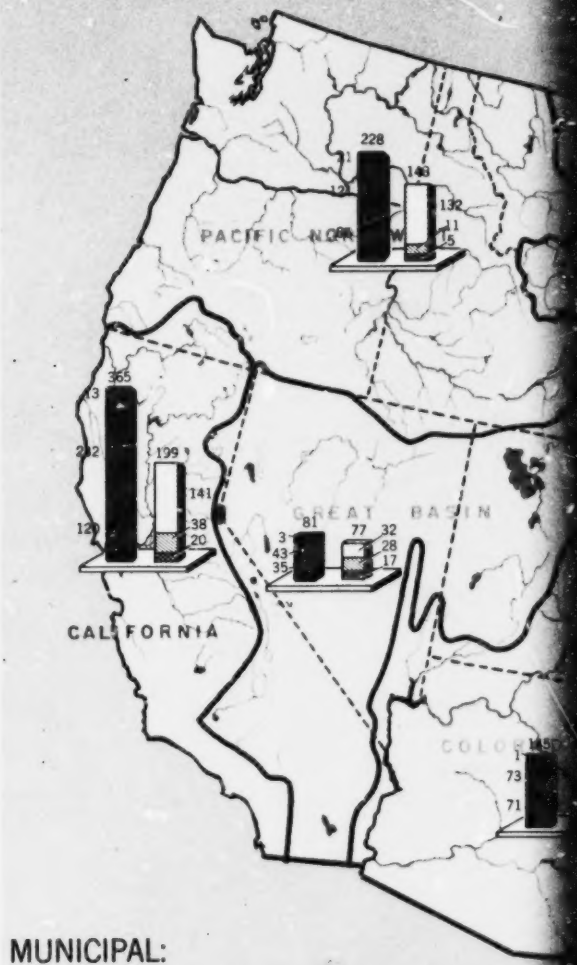
NATIONAL TOTALS

Municipal:

Sewage treatment plants with inadequate capacity	2,541
With adequate capacity	3,531
Adequacy undetermined	583

Industrial:

Waste treatment plants with inadequate capacity	657
With adequate capacity	1,090
Adequacy undetermined	848



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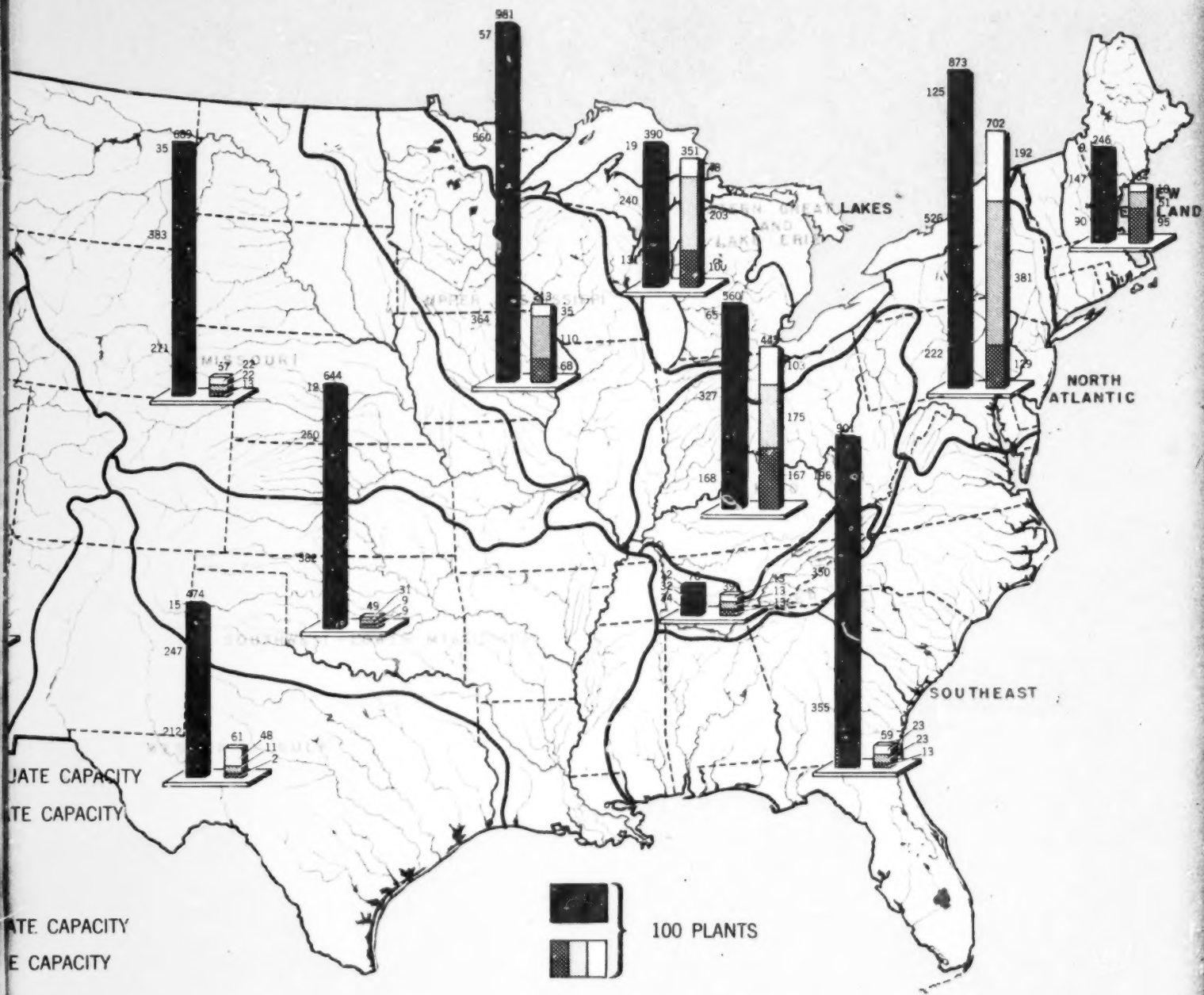


A fast growing population usually outstrips the construction of needed modern facilities such as schools, highways, and water and sewage works. The dark blue and black bar sections show that many of our sewage and industrial waste treatment facilities are overtaxed and should be enlarged or replaced.

TREATMENT PLANTS:
NATIONAL TOTALS

Municipal:

Unsatisfactorily operated sewage treatment plants 1,506

Satisfactorily operated 4,318

Quality of operation undetermined 831

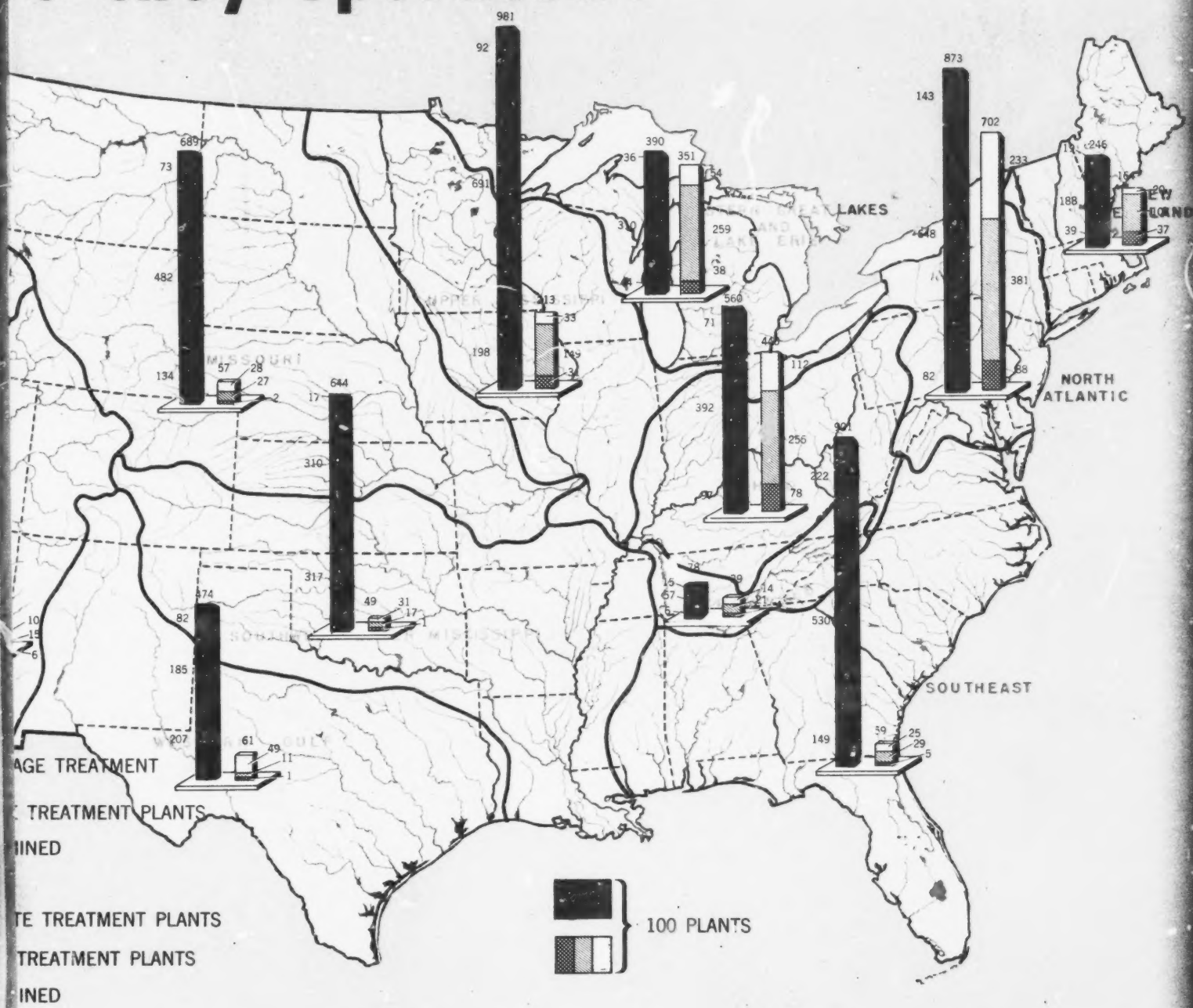
Industrial:

Unsatisfactorily operated waste treatment plants 316

Satisfactorily operated 1,360

Quality of operation undetermined 919

re they operated?



Construction of treatment facilities is only the first step toward keeping our waters clean. The real value of these facilities in combatting pollution rests ultimately in the hands of the men who operate them. The effectiveness of a tremendous public and private investment, running into billions of dollars, depends on their knowledge and skill, and also, adequate operating funds.

CONSTRUCTION:

NATIONAL TOTALS

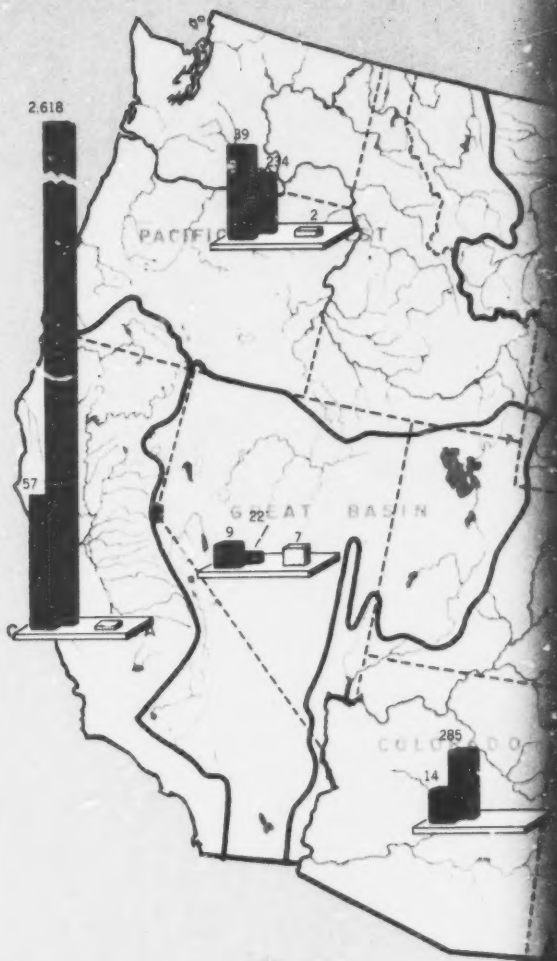
Municipal sewage treatment plants and their design capacity, built 1946-49:

YEAR	NO. OF PLANTS	POPULATION CAPACITY
1946	39	110,545
1947	93	1,953,790
1948	176	1,345,665
1949	338	6,402,032

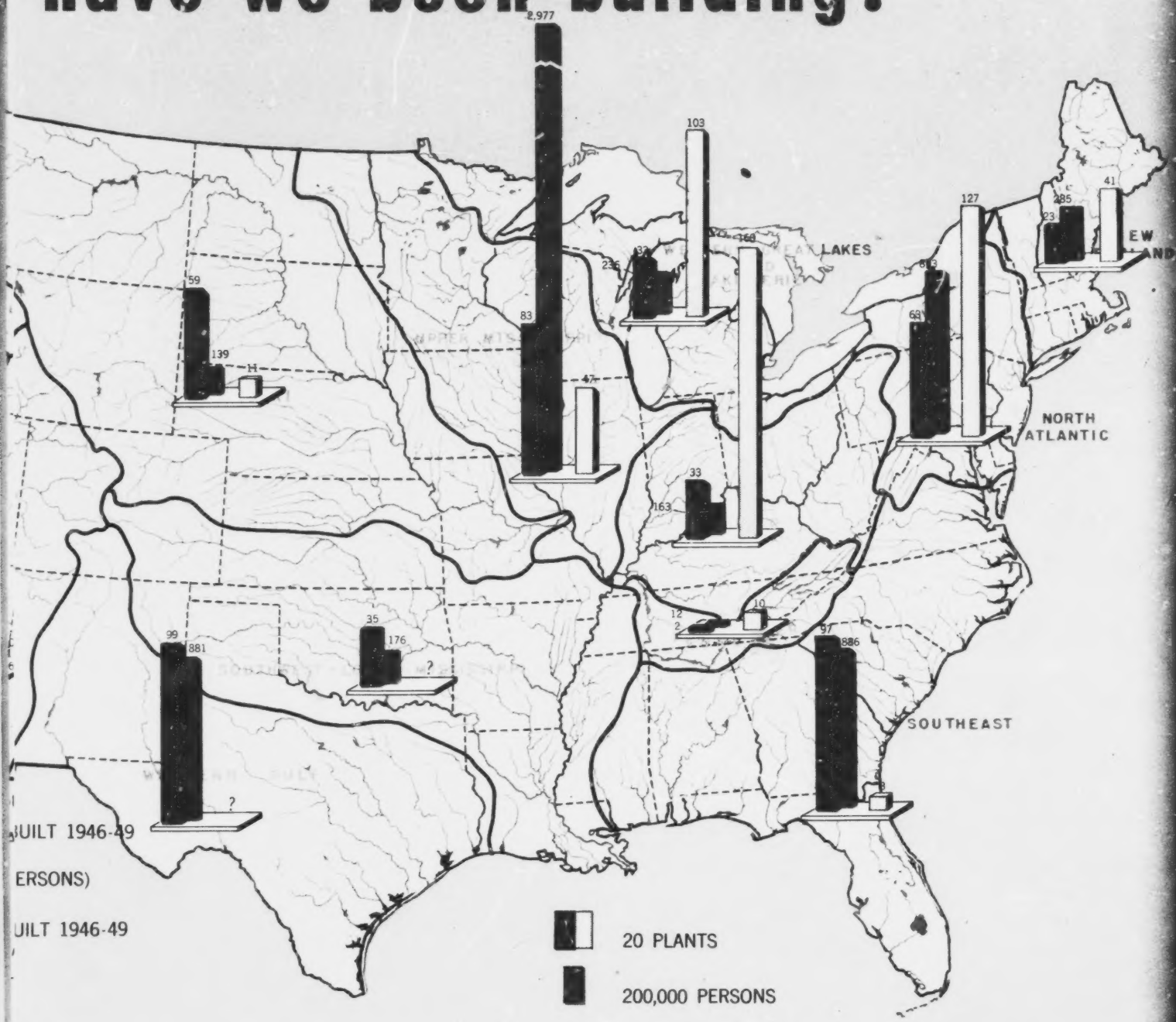
Industrial waste treatment plants, built 1946-49:

YEAR	NO. OF PLANTS
1946	44
1947	97
1948	175
1949	201

At what rate



have we been building?



During the past 10 years, industry stepped up production tremendously to meet World War II needs and our population made unexpected gains. The gap between the volume of waste discharged and the facilities for its treatment widened dangerously in spite of a postwar spurt in treatment plant construction. We cannot afford to let this gap get larger—it must be closed: in critical areas, immediately.

CONSTRUCTION:
NATIONAL TOTALS

Municipal:

Sewage treatment plants under construction . . . 326

Final plans for construction approved . . 854

Plans under preparation . . 961

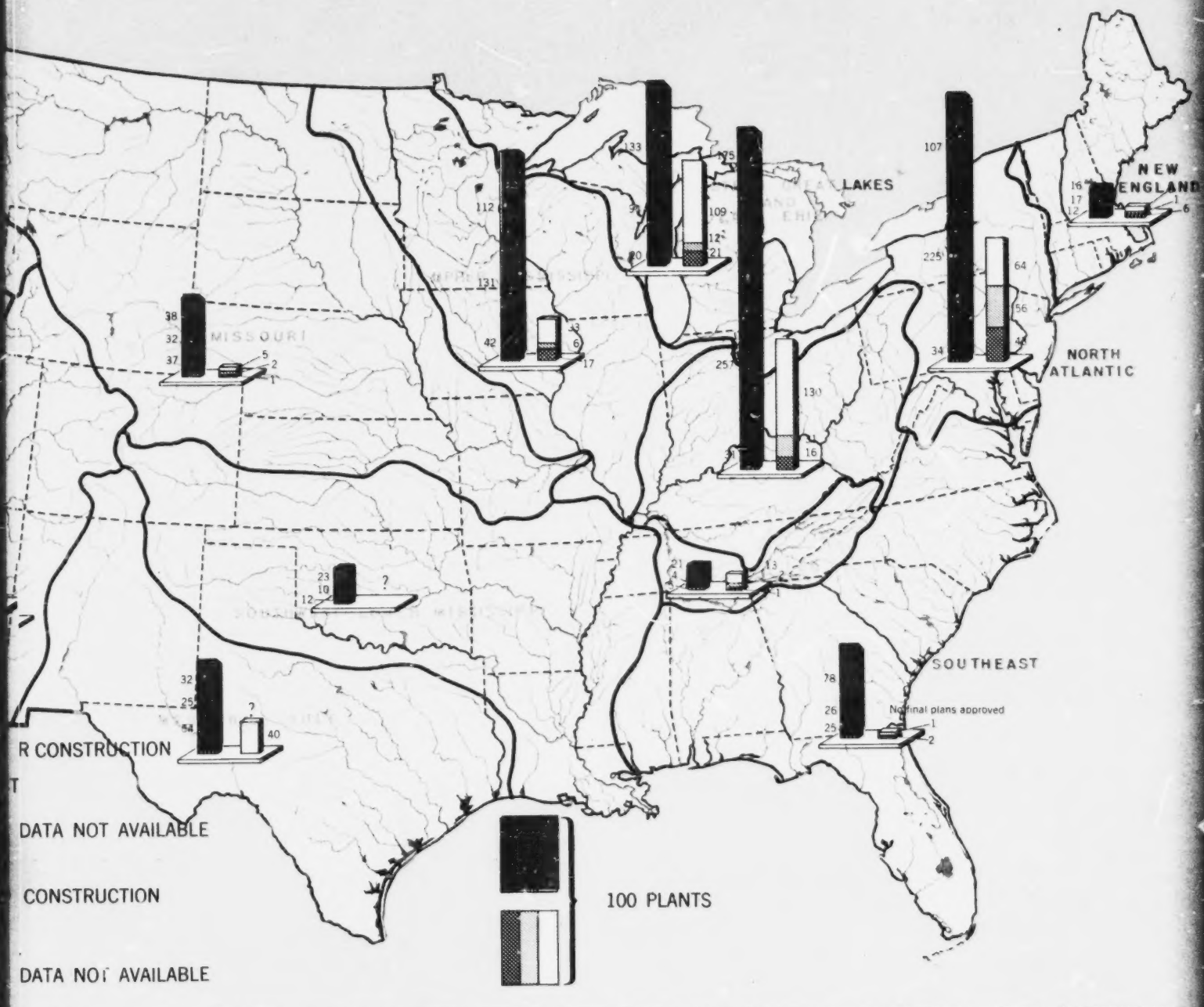
Industrial:

Waste treatment plants under contruction . . . 114

Final plans for construction approved . . 124

Plans under preparation . . 410

ork is planned or under way?



The 440 treatment plants under construction, and the plans for 2,349 more plants approved and under preparation, offer promising assurance that the Nation is increasingly aware of its pollution problem. It is obvious that a great deal of construction work can proceed immediately.

GOALS:

NATIONAL TOTALS

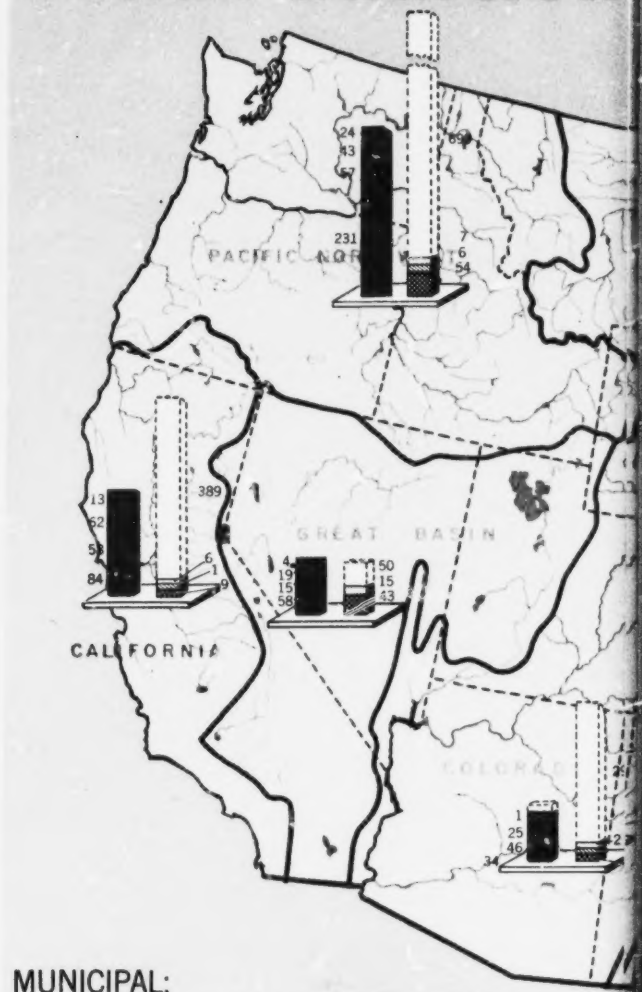
Municipal:

	NUMBER	TO SERVE THIS POPULATION
New sewage treatment plants . . .	4,209	31,010,200
Replacements	722	3,508,400
Additions or enlargements	1,645	25,699,700
Undetermined	1,627	----------

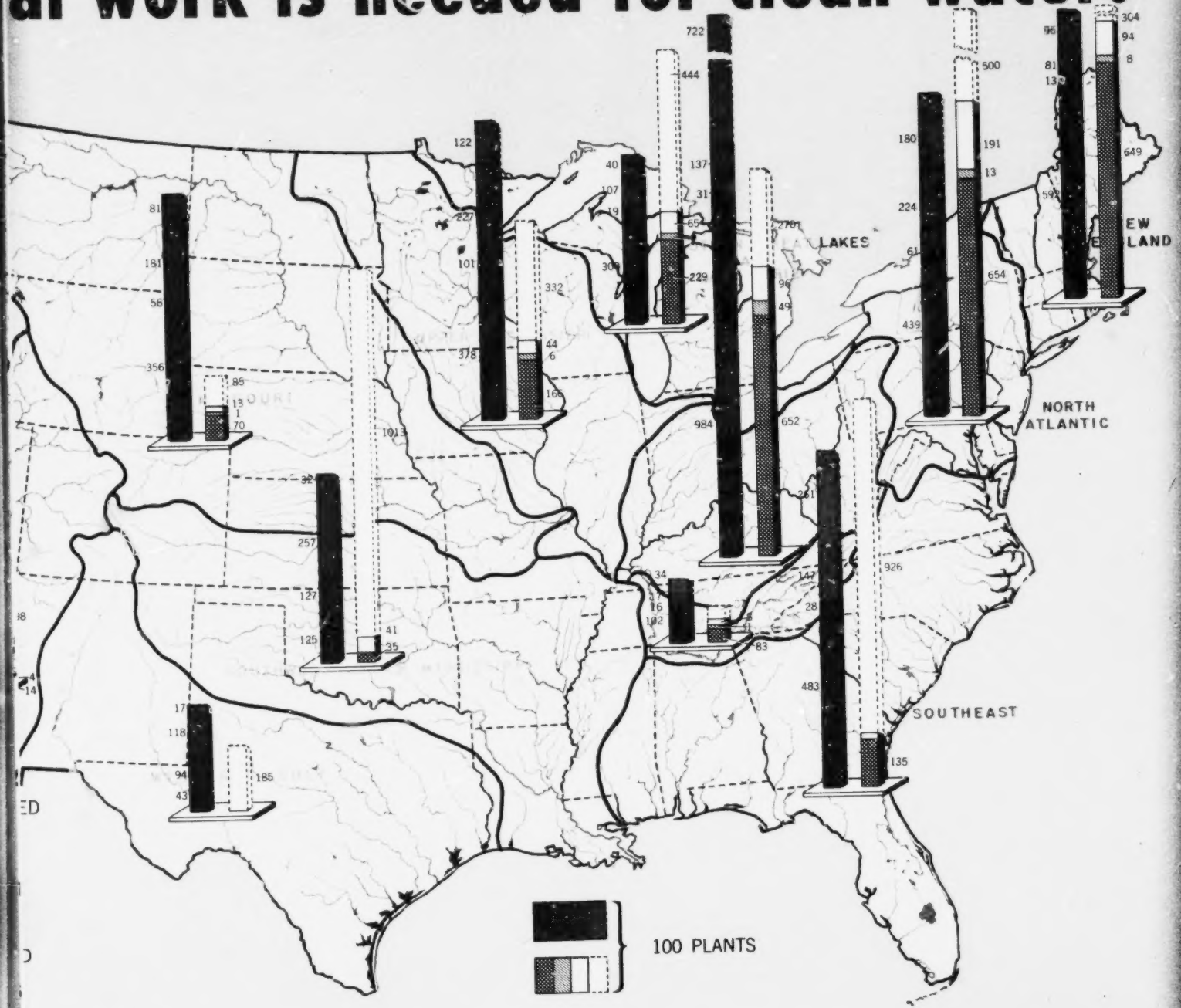
Industrial:

New waste treatment plants . . .	2,793	----------
Replacements	98	----------
Additions or enlargements	591	----------
Undetermined	5,532	----------

What addition



al work is needed for clean water?



Without exception, every major river drainage basin in the country requires the construction of new industrial and municipal waste treatment plants, replacements, enlargements or additions. This is readily apparent from information received on known needs, apart from the large number of additional needs not yet determined.

TABULAR SUMMARY OF BASIC DATA

1	2	3	4	5	6	Municipal sources of pollution											Industrial sources of pollution			
Drainage basin	States or parts of States in basin	Largest rivers in the basin	Largest cities in the basin	Square miles (000's)	Population (000's)	7 Number of municipalities[1]	8 Population served	9 Producing known discharge	10 Population equivalent of discharge[2]	11 Discharge undetermined	12 With primary treatment	13 Population served	14 With secondary treatment	15 Population served	16 Without treatment	17 Population	18 Number of plants[3]	19 Treating waste	20 Not treating waste	21 Undetermined facilities
New England	Maine, N. H., Vt., Mass., R. I., Conn., N. Y.	Connecticut, Kennebec, Penobscot.	Boston, Providence, Worcester.	65	9,200	1,000	6,671,096	838	4,295,668	162	120	1,438,771	126	1,147,052	754	4,085,273	1,146	164	910	72
North Atlantic	Vt., Mass., N. Y., Pa., Del., N. J., Md., D. C., Va., W. Va.	Hudson, Delaware, Susquehanna, Potomac	New York, Philadelphia, Baltimore, Washington.	103	30,000	1,428	23,213,580	679	6,240,831	749	425	7,728,682	417	6,000,136	559	9,184,762	1,784	702	755	327
Southeast	Va., N. C., S. C., Ga., Fla., Ala., Miss.	James, Savannah, Chattahoochee, Alabama-Coosa, Tombigbee.	Atlanta, Birmingham, Miami, Richmond.	280	18,000	1,175	6,544,849	715	3,257,344	460	531	2,122,818	248	1,219,285	396	3,202,746	1,109	59	263	787
Ohio River	Ill., Ind., Ohio, Pa., W. Va., Ky.	Ohio, Allegheny-Monongahela, Wabash.	Pittsburgh, Cincinnati, Indianapolis.	163	18,000	2,187	9,484,861	1,257	8,767,395	930	229	991,230	342	2,709,333	1,616	5,784,298	1,288	445	551	292
Western Great Lakes and Lake Erie	Ohio, Pa., Mich., Ind., Ill., Minn., Wis.	Great Lakes, and streams tributary thereto.	Detroit, Cleveland, Milwaukee.	176	12,500	812	10,397,478	205	2,029,507	607	232	4,881,386	224	3,918,543	356	1,597,549	961	351	274	336
Tennessee River	Va., N. C., Ga., Tenn. Ala., Miss., Ky.	Tennessee, Holston, French Broad, Clinch.	Knoxville, Chattanooga.	40	3,000	200	797,126	185	1,069,445	15	57	100,577	21	64,245	122	632,304	148	39	106	3
Upper Mississippi	Ill., Ind. Iowa, Minn., Mo., N. Dak., S. Dak., Wis.	Mississippi, Red River of North, Illinois.	Chicago, Minneapolis, St. Paul, St. Louis.	230	16,500	1,460	9,947,378	806	5,296,520	654	308	1,287,919	727	6,628,707	425	2,030,752	678	213	197	268

See footnotes at end of table, p. 33.

THESE FIGURES are based on information readily available to State water pollution control agencies as of July 1, 1950. Although lacking some details they present the best available current over-all picture of pollution in the United States. The data perform an equally valuable service, also, in delineating the gaps in the information necessary for a complete, detailed appraisal of the problem.

Industrial sources of pollution—Continued						Adequacy of capacity			Quality of operation			1946–49 construction		Construction under way or planned			Requirements						
22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Producing known organic waste	Population equivalent	Producing undetermined organic waste	Producing inorganic waste	Undetermined type of waste	Number of treatment plants[1]	Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined	Number of plants	Capacity (population or population equivalent)	Plans under preparation	Final plans approved	Under construction	New plants	Capacity (population)	Replace existing plants	Capacity (population)	Additions or enlargements	Capacity (population)	Undetermined
151	1,495,300	745	208	54	Municipal 246	147	90	9	188	39	19	23	285,900	16	17	12	592	3,765,242	13	86,555	81	865,084	96
					Industrial 164	51	95	18	107	37	20	41	No data	8	1	6	649	.....	8	.....	94	.....	304
452	3,597,598	944	592	81	Municipal 873	526	222	125	648	82	143	63	893,055	107	225	34	439	9,256,596	61	979,046	224	7,049,330	180
					Industrial 702	381	129	192	381	88	233	127	[2] 32,807	64	56	43	654	.....	13	.....	191	.....	500
160	3,535,814	207	62	696	Municipal 901	350	355	196	530	149	222	97	886,080	78	26	25	483	2,903,143	28	194,600	147	878,532	261
					Industrial 59	23	13	23	29	5	25	8	29,600	1	0	2	135	.....	0	.....	9	.....	926
388	4,464,602	335	632	55	Municipal 560	327	168	65	392	97	71	33	163,243	175	257	31	984	5,577,116	31	114,159	137	2,092,692	722
					Industrial 445	175	167	103	255	78	112	160	[3] 2,620	130	31	16	652	.....	49	.....	96	.....	270
215	6,169,338	244	535	92	Municipal 390	240	131	19	310	44	36	33	236,201	133	94	20	300	1,590,268	19	51,645	107	6,485,765	40
					Industrial 351	203	100	48	259	38	54	103	[3] 1,048,400	109	12	21	229	.....	9	.....	65	.....	444
87	1,412,730	15	61	3	Municipal 78	32	34	12	57	6	15	2	12,630	21	4	5	102	617,452	16	60,100	17	33,285	34
					Industrial 39	13	13	13	21	4	14	10	108,600	13	2	1	83	.....	1	.....	8	.....	37
94	2,257,040	245	328	18	Municipal 981	560	364	57	691	198	92	83	2,977,468	112	131	42	378	897,802	101	190,710	227	4,067,490	122
					Industrial 213	110	68	35	149	31	33	47	856,963	33	6	17	166	.....	6	.....	44	.....	332

See footnotes at end of table, p. 33.

Tabular Summary of

1	2	3	4	5	6	Municipal sources of pollution											Industrial sources of pollution			
						7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Drainage basin	States or parts of States in basin	Largest rivers in the basin	Largest cities in the basin	Square miles (000's)	Population (000's)	Number of municipalities [1]	Population served	Producing known discharge	Population equivalent of discharge [2]	Discharge undetermined	With primary treatment	Population served	With secondary treatment	Population served	Without treatment	Population	Number of plants [3]	Treating waste	Not treating waste	Undetermined facilities
Southwest-Lower Mississippi.	Kans., Colo., N. Mex., Tex., Okla., Mo., Tenn., Miss., La.	Mississippi, Arkansas, Red, White.	New Orleans, Little Rock, Oklahoma City.	335	11,500	802	4,948,539	208	1,232,545	594	286	855,579	336	1,920,593	180	2,172,367	1,169	49	118	1,002
Missouri River.	Mont., N. Dak., S. Dak., Minn., Wyo., Nebr., Iowa, Colo., Kans., Mo.	Missouri, North Platte, South Platte, Kansas, Yellowstone.	Kansas City, Omaha, Denver.	520	8,200	979	3,530,113	953	3,271,173	26	262	862,484	394	1,012,983	323	1,654,646	188	57	98	33
Western Gulf.	Tex., N. Mex., La., Colo.	Rio Grande, Trinity, Sabine, Neches.	Houston, Dallas, San Antonio, Albuquerque.	295	6,300	485	4,155,496	No data	No data	485	157	425,972	293	3,471,233	35	258,291	196	61	50	85
Colorado River.	Ariz., Colo., N. Mex., Utah., Wyo., Nev., Calif.	Colorado, Green, San Juan, Gila.	Phoenix, Tucson.	250	1,300	178	592,162	4	4,375	174	64	135,105	80	398,616	34	58,441	330	31	39	260
Great Basin	Calif., Idaho, Nev., Utah, Wyo.	Humboldt, Sevier, Truckee-Carson, (Great Salt Lake), (Salton Sea).	Salt Lake City, Reno.	184	1,000	142	590,800	142	623,620	No data	43	88,415	39	96,828	60	405,557	137	77	54	6
California	Calif., Oreg.	Sacramento, San Joaquin, Klamath, Salinas.	Los Angeles, San Francisco, Oakland, San Diego.	111	10,500	529	8,423,185	529	8,723,140	No data	244	3,355,593	194	3,023,856	91	2,043,736	443	199	49	195
Pacific Northwest.	Wash., Oreg., Idaho, Mont., Wyo., Utah, Nev.	Columbia, Snake, Willamette, Pend Oreille.	Portland, Seattle, Spokane.	270	4,600	434	2,465,338	400	3,002,187	34	141	325,212	88	282,411	[3] 205	1,857,715	824	148	195	481
Totals				3,022	150,600	[3] 11,811	91,762,001	6,921	47,813,750	4,890	3,099	24,599,743	3,529	31,893,821	[3] 5,156	35,268,437	[3] 10,401	2,595	3,659	4,147

See footnotes at end of table, p 33.

Basic Data—Continued

Industrial sources of pollution—Continued						Adequacy of capacity			Quality of operation			1946–49 construction		Construction under way or planned			Requirements						
22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Producing known organic waste	Population equivalent	Producing undetermined organic waste	Producing inorganic waste	Undetermined type of waste	Number of treatment plants [1]	Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined	Number of plants	Capacity (population or population equivalent)	Plans under preparation	Final plans approved	Under construction	New plants	Capacity (population)	Replace existing plants	Capacity (population)	Additions or enlargements	Capacity (population)	Undetermined
33	1,357,244	245	114	857	Municipal 644	250	382	12	310	317	17	35	176,080	23	10	12	125	675,932	127	442,640	257	1,306,709	32
					Industrial 49	9	9	31	17	1	31	No data	No data	No data	No data	No data	35		0		41		1,013
110	8,486,503	42	71	1	Municipal 689	383	271	35	482	134	73	59	139,360	38	32	37	356	1,059,899	56	74,370	181	1,174,571	81
					Industrial 57	22	13	22	27	2	28	11	36,070	5	2	1	70		1		13		85
No data	No data	90	61	78	Municipal 474	247	212	15	185	207	82	99	881,250	32	25	54	43	257,608	94	764,250	118	1,081,310	17
					Industrial 61	11	2	48	11	1	49	No data	No data	4	No data	No data	0		0		0		185
52	279,458	22	20	237	Municipal 145	73	71	1	79	51	15	14	285,260	No data	1	4	34	58,441	46	87,181	25	69,416	1
					Industrial 31	15	6	10	15	6	10	0	0	No data	No data	No data	14		4		2		298
95	1,201,150	11	24	7	Muncipal 81	43	35	3	58	22	1	9	22,350	14	1	3	58	402,122	15	45,074	19	37,044	4
					Industrial 77	28	17	32	36	9	32	7	149,500	No data	1	1	43		0		15		50
83	2,797,000	297	62	1	Municipal 365	232	120	13	249	92	24	57	2,618,635	121	5	25	84	2,044,036	58	341,635	62	369,403	13
					Industrial 199	38	20	141	41	11	147	[5] 1	[5] 10,000	No data	9	2	9		1		6		349
211	12,825,773	432	117	64	Municipal 228	121	86	21	139	68	21	39	234,520	91	26	22	231	1,904,586	57	76,408	43	189,086	24
					Industrial 148	11	5	132	12	5	131	[5] 2	[6] 1,030,000	7	4	4	54		6		7		699
2,131	49,979,550	3,874	2,887	2,177	Municipal 6,655	3,531	2,541	583	4,318	1,506	831	646	9,812,032	961	854	326	4,209	31,010,243	722	3,508,433	1,645	25,699,717	1,627
					Industrial 2,595	1,090	657	848	1,360	316	919	[5] 517	[6] 3,304,560	410	124	114	2,793		98		591		5,532

[1] Cities, towns, villages, sewer districts, and institutions.
[2] Including industrial waste discharged into municipal sewer systems.
[3] Discharging waste directly into watercourses.
[4] Includes 27 multiple outlets reported as separate sources.
[5] Includes 24 unsewered communities from which septic tank effluent seeps to watercourse with an estimated population equivalent of over 30,000.
[6] Less than sum of columns 22, 24, 25, and 26 because 668 plants produce both organic and inorganic waste.
[7] Totals do not always equal the sum of municipalities with primary treatment and those with secondary treatment (columns 12 and 14) because some municipalities are served by more than 1 plant, and 1 plant sometimes serves several municipalities.
[8] Data incomplete.

THIS FAMILY can buy protection against water pollution for the price of *a daily candy bar*

PART 3

THE COST AND RESPONSIBILITY

Cleaning up the rivers, lakes and bays of our country will require a great deal of money. To put a dollar sign on the many intangible benefits of pollution abatement, however, would be totally unrealistic. Nevertheless, waste treatment plant construction costs money; and the important question that will be raised by those who have the responsibility for abatement—*all of us*—is: How much?

Cost and Responsibility for Pollution Abatement

To restore our rivers, lakes, and bays to full use after a century of polluting them is a tremendous task. But we have no other recourse.

The sooner the job is attacked with determination the better. The longer the delay, the greater the cost—not so much because of rising prices as from the steadily mounting problem itself—one that must be faced eventually.

All of us now bear the many hidden costs of pollution. All of us will benefit from its abatement. Everybody, therefore, shares the responsibility for abatement.

But mere acceptance of this fact will not in itself cleanse our sickened, wasted waters.

Fundamental Responsibility

Communities not treating their domestic waste are the actual polluters, and upon them rests the final specific responsibility for installing treatment works. They alone have the power to tax the citizen directly for such needed construction.

Likewise, in the abatement of industrial pollution, specific responsibility rests upon the particular industry or plant that discharges untreated waste. They are the polluters—theirs is the responsibility for taking care of their pollution.

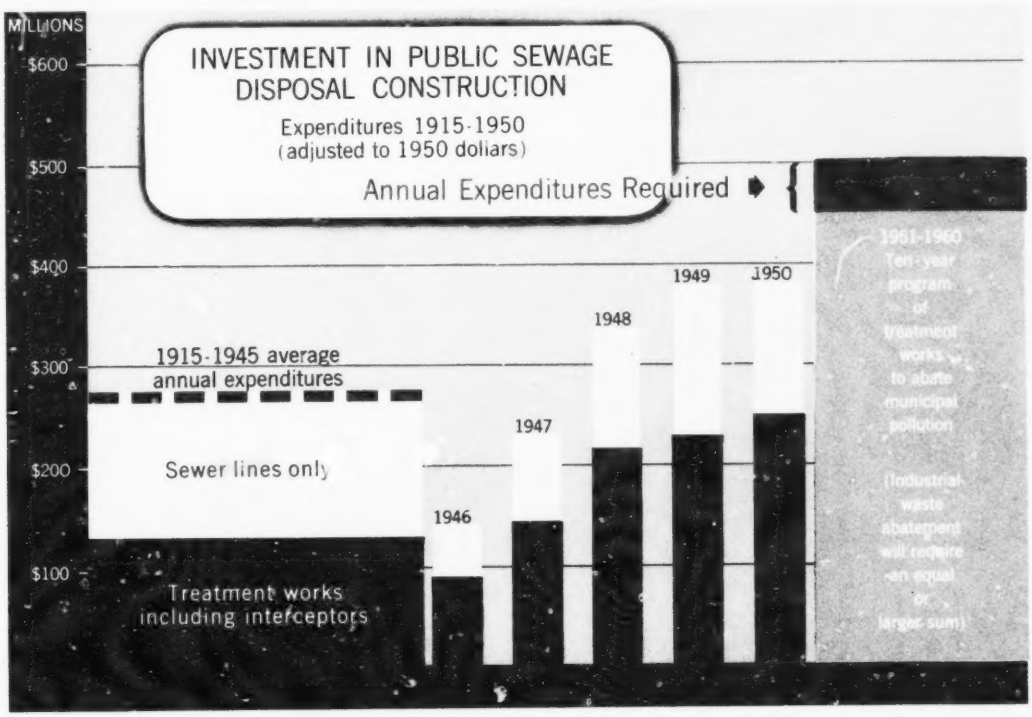
Any other principle would lead to inaction and progressive deterioration of our waters due to pollution.

Financial Assistance

Nevertheless, the widespread character of our pollution problem has impelled some States to make money available to municipalities for public sewage treatment works construction. In the Water Pollution Control Act of 1948 (Public Law 845) the Federal Government also adopted the principle of financially assisting States, interstate agencies and municipalities in such construction.

This is our present national policy. It rests on the basic premise of local responsibility and mutual cooperation in the Herculean task of cleaning up our polluted rivers, lakes, bays and other bodies of water.

Such a policy will succeed, however, only if backed by



the individual citizen. In the final analysis, solution of the Nation's pollution problem depends on public support.

A Modest Price

To justify public support, the cost of pollution abatement must be reasonable. In Indiana, for example, the cost per family for a number of recently built sewage disposal plants averaged less than $1.30 a month.

This modest price to each of our families for ridding the Nation of a menace that threatens our lives and livelihoods may vary somewhat depending on the locality. But it gives us a fair idea of what pollution abatement would cost the average American family.

Estimated Total Investment

The sum of the individual costs of the 6,576 new municipal plants, replacements, additions or enlargements now known to be needed would total nearly $2½ billion. During the next 10 years, the obsolescence of other old treatment plants, the needs of new communities, and an allowance for normal population increase, plus further allowance for presently undetermined needs, would probably require an additional $2 billion based on 1950 prices. This brings the total cost of municipal pollution abatement to about $4½ billion.

For industrial waste abatement, an estimate of the cost is at best a very rough calculation. We have no means of gathering similar cost information for industry generally. But we know that treatment methods for industrial waste, with known exceptions, follow about the same pattern as those for municipal sewage. Furthermore, it is known that the industrial pollution load is somewhat larger than the municipal pollution load. Accordingly, the cost of abating industrial pollution can be estimated conservatively at a sum in excess of that for municipal pollution abatement.

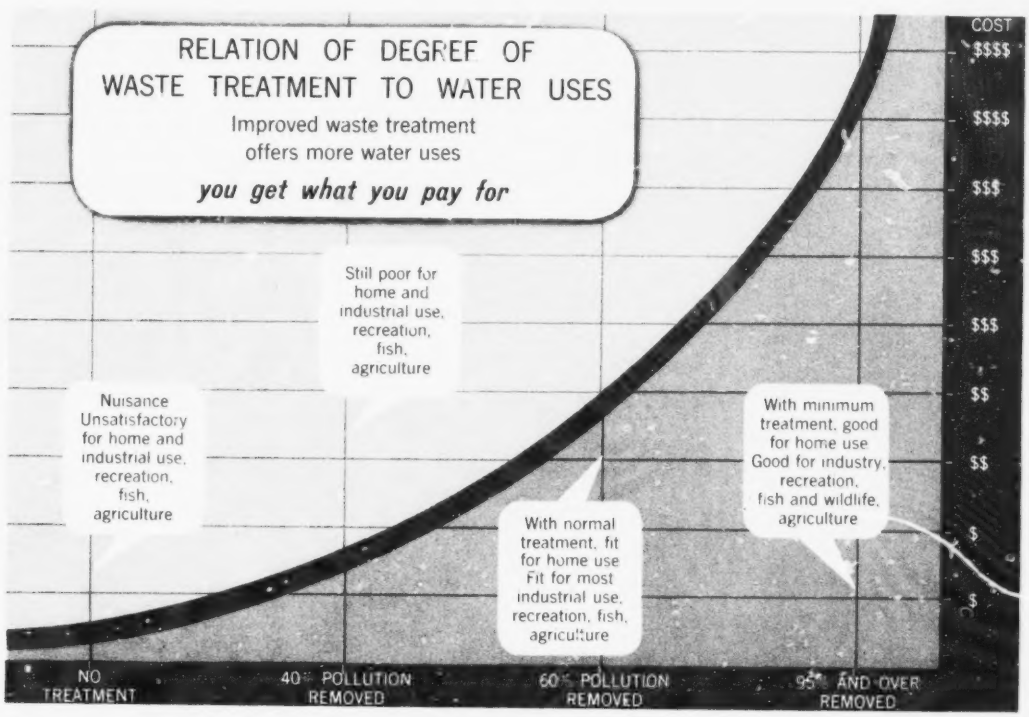
Degrees of Treatment—and of Cost

There are degrees of treatment for waste. The higher the treatment, the cleaner the water and the more uses it is suitable for—and the higher the cost.

On the other hand, the lower the degree of treatment, the more waste our waters must assimilate by natural processes. And also,they will provide fewer uses.

The total cost of a national municipal and industrial pollution abatement program would range roughly from $9 billion to $12 billion, depending on the water uses finally chosen.

When we, the people, determine the best uses for our streams, lakes and bays, with due consideration to all the manifold factors that enter such a complex evaluation, the precise cost of reclaiming our waters can finally be ascertained.


RELATION OF DEGREE OF WASTE TREATMENT TO WATER USES
Improved waste treatment offers more water uses
you get what you pay for
COST
$$$$
$$$$
$$$
$$$
$$$
$$
$$
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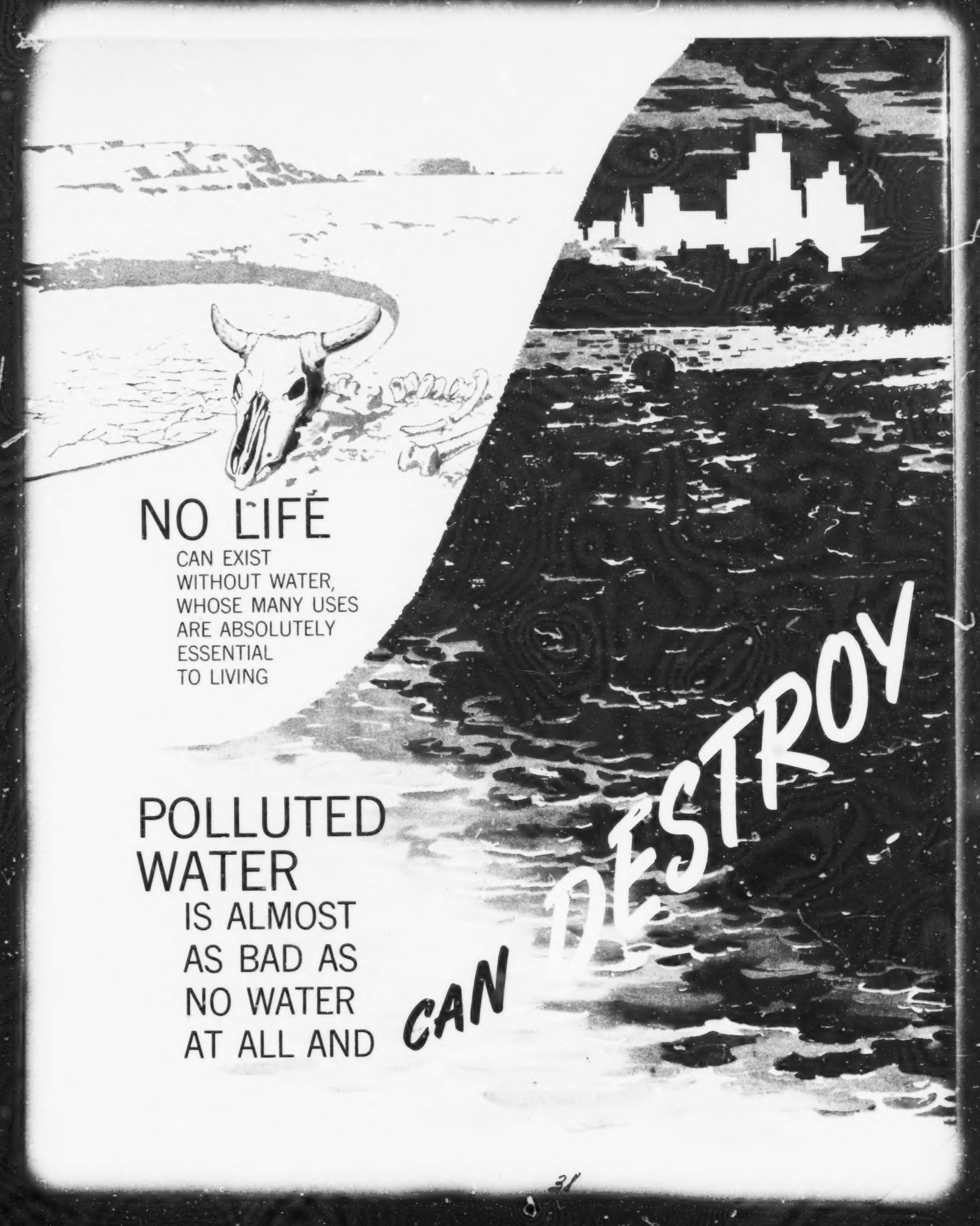
$
Nuisance Unsatisfactory for home and industrial use, recreation, fish, agriculture
Still poor for home and industrial use, recreation, fish, agriculture
With normal treatment, fit for home use Fit for most industrial use, recreation, fish, agriculture
With minimum treatment, good for home use Good for industry, recreation, fish and wildlife, agriculture
NO TREATMENT
40% POLLUTION REMOVED
60% POLLUTION REMOVED
95% AND OVER REMOVED


NO LIFE
CAN EXIST
WITHOUT WATER,
WHOSE MANY USES
ARE ABSOLUTELY
ESSENTIAL
TO LIVING
POLLUTED
WATER
IS ALMOST
AS BAD AS
NO WATER
AT ALL AND
CAN
DESTROY

Domestic

DRINKING
COOKING
WASHING
BATHING
AIR CONDITIONING
SPRINKLING

Industrial

PRODUCING
PROCESSING
COOLING
BOILER FEED
POWER
SANITARY

THESE USES...

Fishing

GAME FISH
COMMERCIAL FISH
SHELLFISH:
OYSTERS, CLAMS, MUSSELS
CRAYFISH

Agricultural

STOCK WATERING
AND
IRRIGATION

Wildlife AND Recreational

WILD ANIMAL
AND BIRD LIFE
SWIMMING
BOATING
PICNICKING
CAMPING

UNLESS...

THE CHALLENGE OF WATER POLLUTION *IS MET*

APPENDIX 1

PUBLIC POLICY ON WATER POLLUTION CONTROL

1—*National Problem*

Water pollution has become a matter of grave concern in many areas, and its damaging effects on the public health and natural resources are a matter of definite Federal concern as a menace to national welfare. Abatement must be undertaken in order to control it.

(Senate Committee on Public Works, Report No. 462, 80th Cong.)

2—*Federal Responsibility*

The Federal Government should take the initiative in developing comprehensive plans for the solution of water pollution problems in cooperation with the States.

(Senate Committee on Public Works, Report No. 462, 80th Cong.)

3—*State Responsibility*

It is hereby declared to be the policy of the Congress to recognize, preserve and protect the primary responsibilities and rights of the States in controlling water pollution.

(Sec. 1, Public Law 845, 80th Cong., June 30, 1948)

4—*Federal Financial Aid*

The extension of Federal credit to local agencies for construction of pollution abatement works will greatly stimulate the construction phase of the comprehensive program and thus encourage the early accomplishment of urgently needed abatement measures.

(Senate Committee on Public Works, Report No. 462, 80th Cong.)

5—*Federal Research and Technical Assistance*

It is hereby declared to be the policy of Congress to support and aid technical research to devise and perfect methods of treatment of industrial wastes which are not susceptible to known effective methods of treatment, and to provide technical services to State and interstate agencies and to industries, and financial aid to State and interstate agencies and to municipalities, in the formulation and execution of their stream pollution abatement programs.

(Sec. 1, Public Law 845, 80th Cong., June 30, 1948)

6—*Enforcement*

The initial responsibility for enforcement (is left) with the States. Federal enforcement is to be exercised only after the efforts of the State have been exhausted, and then only with the consent of the State. The committee is deeply impressed with the serious effects of polluted waters upon the public health and welfare and is firmly convinced that failure to accomplish adequate progress in pollution abatement under the terms of this bill, through the cooperative efforts of the Federal and State agencies, will undoubtedly call for much stronger and more direct Federal enforcement measures at some subsequent session of the Congress.

(Senate Committee on Public Works, Report No. 462, 80th Cong.)

APPENDIX 2

RECOMMENDATIONS OF THE PRESIDENT'S WATER RESOURCES POLICY COMMISSION

Test—The effectiveness of the 1948 Water Pollution Control Act, with its dependence on local-State-Federal cooperation to bring pollution under control, should be thoroughly tested. To assure this test Congress should increase the present inadequate appropriations for the effective discharge by the Public Health Service of its functions under the act and for loans to municipalities and others to enable them to construct the necessary sewage and waste-treatment facilities.

Appropriations—Such provision should include (*a*) appropriations for the administrative and regulatory activities of the Public Health Service, Division of Water Pollution Control, sufficient to make possible adequate staffs in each river basin for the necessary surveys, case preparations, and regulatory actions; and (*b*) funds for Federal loans to municipalities, other public bodies, and industries, at not more than 2 percent interest, covering the entire amounts required to construct sewage and waste-treatment works.

Allotment of Funds—Funds for such loans should be allotted on the basis of pollution-control programs developed as integral parts of comprehensive river-basin programs by the responsible Federal agency in cooperation with other Federal agencies, the States, municipalities, and industries concerned. Such allotments should be made on the basis of need.

Byproducts—Plans for construction of waste-treatment plants, whether municipal or industrial, should include reasonable provision for (*a*) making organic materials in waste available for use, (*b*) utilizing by-product gas, (*c*) reclaiming valuable minerals, and (*d*) processing the discharged water for reuse by industry or recharging ground water.

Multipurpose Integration—Pollution control where it is a problem should be an integral part of comprehensive river-basin programs, with full consideration given to this objective from the beginning of the planning process. So far as consistent with the best over-all use of the resources of the basin, reservoirs should be planned so as to (*a*) avoid aggravation of pollution problems of upstream communities, (*b*) permit fluctuation of the reservoir level to stop propagation of disease-carrying mosquitoes, (*c*) regulate releases of water to make the fullest use of the stream's potential self-purification capacity, with release scheduled beforehand to permit proper classification of the stream for pollution-control purposes.

Time Limit—If this Federal-State-local cooperative pollution-control program fails to provide the country with clean rivers within a period of 10 years, the 1948 act should be reconsidered with a view to providing for Federal enforcement, without the requirement of State consent, where polluted streams are within the jurisdiction of Congress.

APPENDIX 3

DRAINAGE BASIN SUMMARY REPORTS ON WATER POLLUTION

The following 15 river-basin reports prepared in field offices of the Public Health Service are the basis of this national report. A limited number of these technical river-basin reports are available on request.

Summary Report on Water Pollution —California
_____ —Colorado River
_____ —Great Basin
_____ —Lake Erie*
_____ —Missouri River
_____ —New England
_____ —North Atlantic
_____ —Ohio River
_____ —Pacific Northwest
_____ —Southeast
_____ —Southwest-Lower Mississippi
_____ —Tennessee River
_____ —Upper Mississippi
_____ —Western Great Lakes*
_____ —Western Gulf

*Combined and treated as a single basin for the purposes of the graphic presentation in Part 2, Graphic Analysis.

APPENDIX 4

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STREAM POLLUTION CONTROL, Report of the Senate Committee on Public Works on S. 418, 80th Cong., Report No. 462, July 8, 1947.

APPENDIX 5

OFFICIAL STATE AND INTERSTATE WATER POLLUTION CONTROL AGENCIES

(As defined under P. L. 845)

State

ALABAMA
Water Improvement Advisory Commission

ALASKA
Territorial Department of Health

ARIZONA
State Department of Health

ARKANSAS
Water Pollution Control Commission

CALIFORNIA
State Water Pollution Control Board

COLORADO
Department of Public Health

CONNECTICUT
State Water Commission

DELAWARE
Water Pollution Commission of the State of Delaware

DISTRICT OF COLUMBIA
Health Department

FLORIDA
State Board of Health

GEORGIA
Department of Public Health

HAWAII
Territory of Hawaii Department of Health

IDAHO
Department of Public Health

ILLINOIS
Sanitary Water Board

INDIANA
Stream Pollution Control Board

IOWA
State Department of Health

KANSAS
State Board of Health

KENTUCKY
Water Pollution Control Commission

LOUISIANA
Stream Control Commission

MAINE
Department of Health and Welfare

MARYLAND
Water Pollution Control Commission

MASSACHUSETTS
Department of Public Health

MICHIGAN
Water Resources Commission

MINNESOTA
Water Pollution Control Commission

MISSISSIPPI
State Board of Health

MISSOURI
Division of Health

MONTANA
State Board of Health

NEBRASKA
Department of Health

NEVADA
State Department of Health

NEW HAMPSHIRE
Water Pollution Commission

NEW JERSEY
State Department of Health

NEW MEXICO
Department of Public Health

NEW YORK
State Department of Health

NORTH CAROLINA
State Board of Health

NORTH DAKOTA
State Department of Health

OHIO
Department of Health

OKLAHOMA
State Health Department

OREGON
State Board of Health

PENNSYLVANIA
Sanitary Water Board

PUERTO RICO
Department of Health

RHODE ISLAND
Department of Health

SOUTH CAROLINA
Water Pollution Control Authority

SOUTH DAKOTA
Committee on Water Pollution

TENNESSEE
Stream Pollution Control Board

TEXAS
State Department of Health

UTAH
State Department of Health

VERMONT
State Water Conservation Board

VIRGINIA
Water Control Board

VIRGIN ISLANDS
Department of Health

WASHINGTON
Pollution Control Commission

WEST VIRGINIA
State Water Commission

WISCONSIN
Committee on Water Pollution

WYOMING
State Department of Health

Interstate

ATLANTIC STATES MARINE FISHERIES COMMISSION
Mount Vernon, New York

BI-STATE DEVELOPMENT AGENCY
St. Louis 1, Missouri

GULF STATES MARINE FISHERIES COMMISSION
New Orleans 16, Louisiana

INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN
Philadelphia 3, Pennsylvania

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN
Washington 6, D. C.

INTERSTATE SANITATION COMMISSION
New York 7, New York

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION
Boston 8, Massachusetts

OHIO RIVER VALLEY WATER SANITATION COMMISSION
Cincinnati, Ohio

PACIFIC STATES MARINE FISHERIES COMMISSION
Portland, Oregon

TRI-STATE WATER COMMISSION
Fargo, North Dakota

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